Instruments for Groundwater management

Murcia – 25th of November
Overview

1. Introduction
   - Groundwater overexploitation: key figures
   - The tragedy of the Commons

2. Instruments for groundwater management
   - Quantity instrument
   - Pricing instrument
   - Mixed instrument
   - Aquifer contract

3. Comparative analysis: centralized management vs decentralized management
   - Case studies
   - Lessons and recommendations

November 2014
Key figures

- Global groundwater exploitation multiplied by **3 in 50 years**

- Around **1 000 km³ abstracted** per year:
  - 67% for irrigation
  - 22% for drinking water
  - 11% for industries
Key figures

- India: 25%
- US: 11%
- China: 11%
The tragedy of the Commons

- Open access to the resource
- A situation with competition to use the water, and
- Many users who behave independently

Externalities: consequence of the withdrawal of one user on the other users

Increase in pumping costs

- At the end: ineluctable overexploitation of the resource

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Instruments for groundwater management

- **Quantity instrument**: quotas
- **Pricing instrument**: taxes
- **Mixed instrument**: water right market
- **Local and decentralized instrument**: Aquifer contract

*Studied by Elinor Ostrom, Nobel Prize in economics, 2009*
Aquifer contract

- Contract between users, and between Administration and users
- Self regulation by users
- Advantages:
  - Better knowledge of the resource, the costs, etc.
  - Limited transaction costs
  - Social empowerment
  - Institutional framework for the implementation of the other instruments
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| Description of the instrument | ISRAEL:  
Agricultural sector = Adjustment variable during drought  

**Nationwide implementation**  
| BEAUCHE AQUIFER - France:  
Local implementation: definition of 4 geographic sectors  
Individual quotas defined at **the beginning of the season** and revised during the season according to the aquifer's level. |
|---|---|
| Stakeholders who impulsed the implementation of the instrument | ISRAEL: State  
BEAUCHE AQUIFER - France: Local stakeholders (farmers) and the State (Prefects) |
| Date of implementation | ISRAEL: The mid-1980s  
BEAUCHE AQUIFER - France: 1999 |
| Stakeholders targeted by the instrument | ISRAEL: Majority of farmers and a few industrials  
BEAUCHE AQUIFER - France: Farmers |
| Water management instrument | ISRAEL: Quotas + Incentive pricing system  
BEAUCHE AQUIFER - France: Quotas implemented within a water development and management plan (SAGE) |
| Socioeconomic evaluation of the instrument | ISRAEL: Reluctance of farmers and strong opposition of the agricultural lobbies  
Nevertheless the agricultural productivity has increased  
BEAUCHE AQUIFER - France: Farmers acceptance |
| Environmental evaluation of the instrument | ISRAEL: No environmental impact: Reduction of agricultural withdrawals offset by the increase in urban abstractions  
BEAUCHE AQUIFER - France: Compliance with the quotas |
## TAXES: Centralized management vs decentralized management

<table>
<thead>
<tr>
<th></th>
<th>THE NETHERLANDS</th>
<th>AQUITAIN AQUIFERS - France</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water management instrument</strong></td>
<td>Groundwater abstraction tax</td>
<td>Increase in water abstraction tax + quotas within a water development and management plan (SAGE)</td>
</tr>
<tr>
<td><strong>Stakeholders targeted by the instrument</strong></td>
<td>Mostly drinking water users</td>
<td>Drinking water</td>
</tr>
<tr>
<td><strong>Date of implementation</strong></td>
<td>1995</td>
<td>2003</td>
</tr>
<tr>
<td><strong>Stakeholders who impulsed the implementation of the instrument</strong></td>
<td>The State</td>
<td>Local Stakeholders (councillor) supported by the Water Authority</td>
</tr>
<tr>
<td><strong>Description of the instrument</strong></td>
<td>Nationwide implementation</td>
<td>Localized overexploitation but increase in taxes for all the users Increase in taxes for financing creation of water resource alternatives</td>
</tr>
<tr>
<td><strong>Socioeconomic evaluation of the instrument</strong></td>
<td>Conflicts between users Lack of equity: Drinking water users financed the agricultural externalities Tax removed because of inefficiency</td>
<td>The measures are considered a success for the majority of the stakeholders</td>
</tr>
<tr>
<td><strong>Environmental evaluation of the instrument</strong></td>
<td>No impact: Decrease in drink water abstraction offset by the withdrawals of the exempt users.</td>
<td>Decrease in drinking water withdrawals per inhabitant of 14% between 2003 and 2010</td>
</tr>
</tbody>
</table>
## WATER RIGHT MARKET: centralized management vs decentralized management

<table>
<thead>
<tr>
<th></th>
<th>CHILE (Centralized management)</th>
<th>RAYMOND AQUIFER - CALIFORNIA (Decentralized management)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water management instrument</td>
<td>Water rights market</td>
<td>Water rights market</td>
</tr>
<tr>
<td>Stakeholders targeted by the instrument</td>
<td>All users</td>
<td>All users (mostly drinking water)</td>
</tr>
<tr>
<td>Date of implementation</td>
<td>1981</td>
<td>1955</td>
</tr>
<tr>
<td>Stakeholders who impulsed the implementation of the instrument</td>
<td>The State</td>
<td>The town of Pasadena (the main user)</td>
</tr>
<tr>
<td>Description of the instrument</td>
<td>Nationwide implementation</td>
<td>Trade between users of Raymond aquifer (15 users)</td>
</tr>
<tr>
<td>Socioeconomic evaluation of the instrument</td>
<td>- A few transactions</td>
<td>Acceptance of the instrument by all the users</td>
</tr>
<tr>
<td></td>
<td>- Lot of obstacles to the proper functioning of the market (high transaction costs, cultural habits, geographic and technical constraints…)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- No safeguard against speculation on water</td>
<td></td>
</tr>
<tr>
<td>Environmental evaluation of the instrument</td>
<td>No major impact on the resources</td>
<td>Compliance with the quotas Sustainibility of the aquifer</td>
</tr>
</tbody>
</table>

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Lessons and recommendations

- Implementation of the instrument in a decentralized framework is **efficient**
  - Favours acceptability and solidarity
  - Limits users conflicts
  - Adapted to the local context
  - Quite easily adjustable to the evolution of the uses

- **Sustainability of the uses and the resource**

- Main findings and recommendations from the Mediterranean cases studies:
  - Creation of a structure which carries the process
  - Neutrality of the decision-making body
  - Consistency with the other policies implemented on the territory
Let’s put it in action

- National Workshop on groundwater management, Skhirat, Morrocco, March 2014
  - Definition of prerequisites of an aquifer contract
  - Reflection on the minimum content of an aquifer contract
  - List of conditions for the implementation and success of the process

- Your experience? Projects? Point of view? Expectations? … on the implementation of decentralized groundwater management
Thank you for your attention
Appendix 1: Design principles for common pool resource institutions (Ostrom, 1990)

1- Clearly define boundaries (effective exclusion of external un-entitled parties)
2- Rules regarding the appropriation and provision of common resources that are adapted to local conditions;
3- Collective-choice arrangements that allow most resource appropriators to participate in the decision-making process;
4- Effective monitoring by monitors who are part of or accountable to the appropriators;
5- A scale of graduated sanctions for resource appropriators who violate community rules;
6- Mechanisms of conflict resolution that are cheap and of easy access;
7- Self-determination of the community recognized by higher-level authorities;
8- In the case of larger common-pool resources, organization in the form of multiple layers of nested enterprises, with small local CPRs at the base level
## Appendix 2: Obstacles and suggestions for resolution

<table>
<thead>
<tr>
<th>Obstacles</th>
<th>Résolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reluctance of users</td>
<td>Information campaigns, presence of relay actors, awareness</td>
</tr>
<tr>
<td>Reluctance of the Administration to delegate work</td>
<td>Discussion, meeting, information sharing</td>
</tr>
<tr>
<td>Lack of coordination between local policies</td>
<td>Discussion, meeting, information sharing</td>
</tr>
<tr>
<td>No compliance with the water management rules</td>
<td>Awareness, effective monitoring</td>
</tr>
<tr>
<td>Cost of drilling declaration</td>
<td>Financial aids</td>
</tr>
<tr>
<td>No compliance with the water management rules</td>
<td>Give the necessary means to the authority in charge</td>
</tr>
<tr>
<td>Lack of knowledge about abstractions</td>
<td>Human and material investments (studies, meters, employees, ...)</td>
</tr>
<tr>
<td>Arduous and slow process</td>
<td>According to the context: strengthen the facilitation and the organization, gather the stakeholders around short-term projects, ...</td>
</tr>
<tr>
<td>Difficulties encountered during the implementation of a precursor process (high transaction costs, lack of experience, lack of information, ...)</td>
<td>- Progress step by step - Flexibility to adjust the process - Establishment of test areas - Restriction of the process to a homogeneous sector (same users, same cultural values, etc.)</td>
</tr>
<tr>
<td>Approach dictated by basin authorities</td>
<td>Give more freedom to local actors in the development of the approach</td>
</tr>
</tbody>
</table>